PATENT SPECIFICATION

Convention Date (Sweden): Feb. 27, 1919.

139,512

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Complete Accepted: July 2, 1920.

COMPLETE SPECIFICATION.

Improvements in or relating to Roller-bearings.

We, AKTIEBOLAGET SVENSKA KULLAGERFABRIKEN, of Artillerigatan 17, Gothenburg, Sweden, Manufacturers, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention is for improvements in or relating to roller-bearings whereof one of the races or track-surfaces is of spherical form. An object of the present invention is to provide a construction whereby the rollers will be adequately guided between the track-rings in such a manner as to obviate the risk of the rollers being turned obliquely across the track-surfaces when the bearing is in use. Roller-bearings hitherto have been subject to this danger which results in jamming of the bearing.

According to the present invention a roller-bearing comprises in combination a track-ring having a spherical race or races, another track-ring having a non-spherical race or races, rollers between the said track-rings, the races and rollers being so shaped and disposed in relation to one another that the resultants of the pressures acting between each of the rollers and an inner and an outer track respectively are inclined at such an angle to one another that they tend to move the roller in the direction of its axis and one or more pressure-resisting or guiding flanges formed integral with or rigidly connected to the track-ring which is provided with a non-spherical race or races, the said flange or flanges being provided to engage the rollers and to resist displacement of them in the direction of their axes.

The foregoing and other features of the invention will be more clearly understood from the following description read in conjunction with the accompanying drawings which illustrate several preferred forms of the invention and in which—

Figure 1 is a partial section in a radial plane of a bearing having two sets of rollers and embodying the features of the present invention;

Figure 2 is a partial side elevation of the bearing illustrated in Figure 1;

Figure 3 is a section similar to that of Figure 1 on a larger scale of a bearing similar to that shown in Figures 1 and 2;

Figures 4, 5 and 6 are respectively sectional views similar to Figure 1 of modified forms of the invention;

Figure 7 shows a similar section of a three-set bearing, and

Figures 8 and 9 are similar sections respectively of two further forms of roller-bearing adapted for taking up both radial and end thrusts.

Referring to Figures 1 and 2 of the drawings, the bearing shown in said figures has an integral outer bearing ring 1 provided with a spherical race. The shape of the rollers 2 is such that they coincide with the spherical race and the shape of the races of the inner integral ring 3 is such that they likewise coincide with the rollers, *i.e.* the curvature of the cross-sections of all races as well as the longitudinal section of the rollers have equal radii, the result being that the rollers and races of both rings have line contact. Such line contact at both rings is, however, not necessary for the object aimed at by the present invention, in as much as it will be sufficient if the rollers make line contact with one (spherical) race and point contact with the other (non-spherical) race. For obtaining point contact with the spherical race and line contact with the non-spherical races the generatrix of the rollers is formed as an arc having a smaller radius than that of the spherical race and the cross-section of the non-spherical races are formed as arcs the radii of which are equal to that of the generatrix of the rollers. For obtaining line contact at the spherical race and point contact at the non-spherical races the generatrix of the rollers is formed as an arc the radius of which is equal to the radius of the spherical race and the

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cross-section of the non-spherical races as arcs having a greater radius than the generatrix of a roller. If desired, the bearing may be so constructed that the rollers have point contact with the races of rings, the radius of the spherical race as well as of the cross-sections of the non-spherical races being in such case greater than the radius of the generatrix of a roller. In each case the rollers are so formed in relation to the races that the resultant of the pressure at the outer race and the resultant of the pressure at the inner race form an angle with each other so that the resultant of these two forces is such as to act on a roller in the direction of its axis.

For taking up said resulting force a guiding flange 4 is arranged, according to the construction shown in Figures 1 to 3, at one side of the non-spherical race. This flange may be integral with the race ring or may be rigidly connected therewith in any suitable manner. The guiding flange 4 may suitably be common for both rows of rollers but a separate flange may be provided for each row of rollers if the distance between the rows is sufficiently great.

Figure 3 illustrates the forces acting on the rollers in a bearing of the type shown in Figures 1 and 2. The resultant of pressure *a* at the outer spherical race is directed towards the centre *o* of said race. The forms of the rollers and the inner or non-spherical races are so chosen that the resultant of pressure *b* at an inner race is less inclined to the geometrical axis *x—x* of the bearing than the resultant *a—o* and consequently forms an angle with the latter intersecting it in a point *c*. The two resultants *a* and *b* combine in a third resultant which acts on the roller in the direction *c—d* and tends to move the roller towards the central plane *o—y* of the bearing. Said resultant is compensated by a reaction *d* from the guiding flange 4 which holds the roller in balance in the bearing. When the bearing is in use the rollers are pressed against the said flange 4 and are thereby satisfactorily guided at their inner end surfaces and prevented from turning to an oblique position in the bearing. The rollers maintain their correct positions at all times and roll evenly and without jamming, which advantage more than compensates for the additional friction which is caused by the guiding flange and the convex form of the rollers.

In Figure 3, t_1, t_2 are tangents to the roller surfaces at the points in which they are cut by the resultants *a* and *b*. The rollers and their races should preferably be such that the tangents, for the sake of minimising friction, intersect one another in a point on or near to the axis *x—x* of the bearing.

Thus the rollers according to the present invention, for use with bearings having spherical outer races, are each of convex form so shaped that its greatest diameter lies nearer to one (the inner) end surface than to the other. The resultants of pressure *a* and *b* will then be to one side of the position of greatest diameter. If desired, the greatest diameter may coincide with one (the inner) end surface of the roller.

The form of the guiding flange may be varied without departing from the principle of the invention. In Figure 1 the side surfaces of the flange have been shown as concave to accommodate spherically formed inner ends of the rollers. Instead of said form the side surfaces of the guiding flange may have a conical form, the end surfaces of the rollers being in such case either plane or conical.

In Figure 1 a roller cage 5 is illustrated and comprises a solid ring having laterally extending projections forming pockets for reception of the rollers.

The bearing shown in Figure 4 differs from that shown in Figure 1 only by the construction of the roller cage, the latter consisting of two sheet metal rings 6, 7 bearing against each other or being rigidly connected with each other, said rings having folded projections or tongues 8, 9 projecting into the spaces between the rollers and holding the latter spaced apart from one another. The projections or tongues 8 are suitably positioned about midway between the inner and outer races, while the projections 9 form supports for the rollers near to the spherical race and also at the outer ends of the rollers.

Figure 5 shows a modification having spherical inner race 3, the rollers 2 having concave rolling surfaces the generatrix of which corresponds to the spherical race 3. The outer race ring 1 has two convex races the cross-section of which has a radius equal to that of the generatrix of the rollers so that said races likewise are suited to the rollers. The guiding flange 4 is disposed on the outer race ring between its races. The arrangement and form of races and rollers in this modification as well as in the following ones are, in principle, the same as in the bearing shown in Figures 1 and 2, the rollers being pressed against the guiding flange.

As in the bearing shown in Figure 1 it is possible to have point contact between the rollers and one race in the bearing according to Figure 5. For obtaining point contact at the spherical race and line contact at the non-spherical race the generatrix of the rollers is an arc having a greater radius than that of the spherical race and the transverse curvature of such of the outer races has a radius equal to the radius of the generatrix of the roller. For obtaining line contact at the spherical race and point contact at the non-spherical races the generatrix of the rollers is formed at an arc the radius of which is equal to the radius of the spherical race and the transverse curvature of each of the non-spherical races has a smaller radius than that of the generatrix of the rollers.

As is shown in Figure 5, the rollers (for bearings having an inner spherical race) have concave rolling surfaces of such form that its smallest diameter is positioned nearer to one (the outer) end surface than to the other. If desired, the smallest diameter of the roller may coincide with one (the outer) end surface.

The bearings shown in Figures 1—5 are chiefly intended to be used for accommodating radial loads and, in certain circumstances, a small axial thrust in either direction. For that purpose both rows of rollers are arranged symmetrically in relation to a central plane of the bearing at right-angles to the axis of the bearing; and both rows of rollers are disposed close to said plane, the direction of the pressures acting upon a roller being nearly at right-angles with the axis of the bearing.

When the bearing is required to sustain a radial load and also an axial thrust acting in one direction only the bearing may suitably be made asymmetric as is shown in Figure 6. As in Figure 1 the outer ring 1 has a spherical race and the inner ring 3 two concave races. One set of rollers 2^a is disposed very nearly centrally in respect of a plane which is transverse to the axis of the bearing and contains the centre of the spherical race. The rollers are guided by two flanges 4^a and 4^b at opposite ends of the rollers while the set of rollers 2^b is guided by the flange 4^b, in as much as the resultants of pressure at the inner and outer races form an angle with each other in the same manner as in Figure 3 the rollers 2^b being, accordingly, pressed against said flange.

The bearing shown in Figure 7 differs from the bearing shown in Figure 6 in that it has three rows of rollers 2^a, 2^b and 2^c of which the rows 2^b and 2^c are adapted to take up axial thrusts in opposite directions.

In all forms described above the bearing is self-contained as it is provided with one set of rollers on one side and another set, or a portion of each of the rollers of that set, on the other side of a centre at right-angles to the axis of the bearing and passing through the centre of the spherical race.

The bearings according to this invention may, however, be non-self-contained by arranging all the rollers, in one or more sets, to one side of said centre plane without the use of any set of rollers on the other side of such plane. Figure 8 shows an example of such a two-set roller bearing. The rollers 2^a are in this modification guided between the guiding flanges 4^a and 4^b while the rollers 2^b are guided by the flange 4^b. The pressures acting on both sets of rollers 2^a and 2^b are such that their resultants cause rollers 2^a to be pressed against the guiding flange 4^a and the rollers 2^b to be pressed against the guiding flange 4^b when the bearing is in use.

Figure 9 shows another form of bearing which is not self-contained and in which only one set of rollers 2 is disposed between a spherical race on the outer race ring 1 and a race having a concave cross-section on the inner race ring 3. Guiding flanges 4^a and 4^b, on the inner ring 3, are arranged at opposite sides of the set of rollers and the races and the rolling surfaces of the rollers are so shaped that the latter, when the bearing is in use, are pressed against the guiding flange 4^a, the flange 4^b being only an auxiliary flange which may, if desired, be omitted.

Either of the bearings shown in Figures 8 and 9 is adapted to take up radial loads and axial thrust in one direction and is particularly adapted for use in such cases where it is desired to remove, by axial displacement, a shaft journalled in the bearing, together with inner bearing ring attached to the shaft.

It is to be understood that the invention is not limited to the above described constructional forms thereof, as they can be modified without departing from the essential features of the invention.

Having now particularly described and and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A roller bearing, comprising in com-

bination a track-ring having a spherical race or races, another track-ring having a non-spherical race or races, rollers between said track-rings, the races and rollers being so shaped and disposed in relation to one another that the resultants of the pressures acting between each of the rollers and an inner and an outer track respectively are inclined at such angle to one another that they tend to move the roller in the direction of its axis, and one or more pressure resisting or guiding flanges (for example 4 or 4^a, 4^b) formed integral with or rigidly connected to the track-ring which is provided with the non-spherical race or races, the said flange or flanges being provided to engage the rollers and to resist displacement of them in the direction of their axes.

2. A roller bearing as claimed in Claim 1 characterised by the rollers being formed with convex rolling surfaces and each with its greatest diameter nearer to one end of it than to the other end.

3. A roller-bearing as claimed in Claim 1, characterised by the guiding flange being situated between two rows of rollers and common to both of them.

4. A roller-bearing as claimed in Claim 1, characterised by a guiding flange situated at each side of the non-spherical race.

5. A roller-bearing constructed, arranged and operating substantially as described and illustrated in any one of the forms shown in the accompanying drawings.

Dated this 26th day of February, 1920.

BOULT, WADE & TENNANT,
111 & 112, Hatton Garden, London, E.C. 1,
Chartered Patent Agents.

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139,512. Complete Specification of AKTIEBOLAGET SVENSKA KULLAGERFABRIKEN

SHEET 1.

Fig. 1

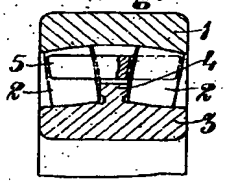


Fig. 2

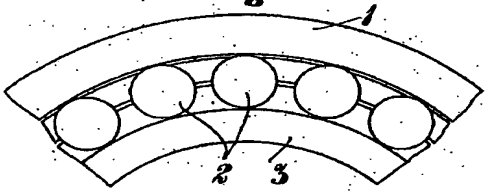
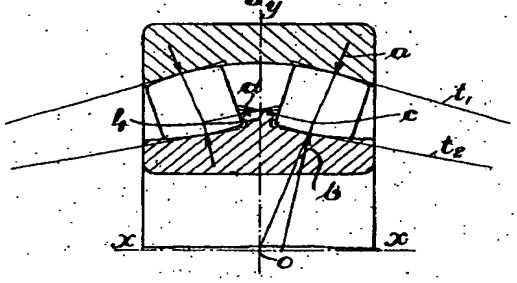


Fig. 3



SHEET 2.

Fig. 4

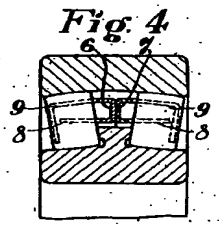


Fig. 5

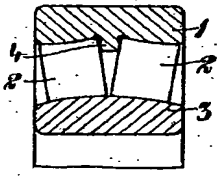


Fig. 6

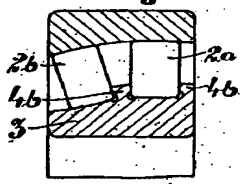


Fig. 7

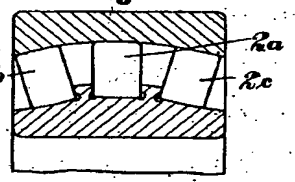


Fig. 8

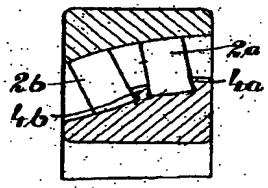
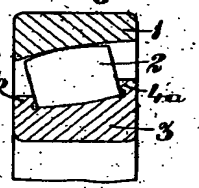


Fig. 9



139,512. COMPLETE SPECIFICATION OF AKTIEBOLAGET SVENSKA KULLAGERFABRIKEN

[This Drawing is a reproduction of the Original on a reduced scale]

Fig. 1

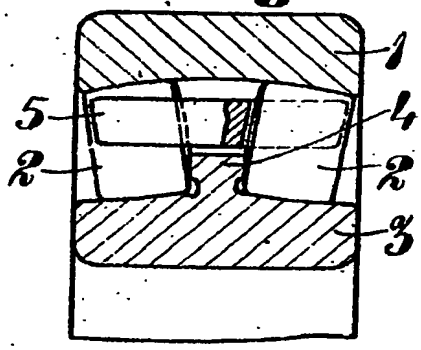


Fig. 2

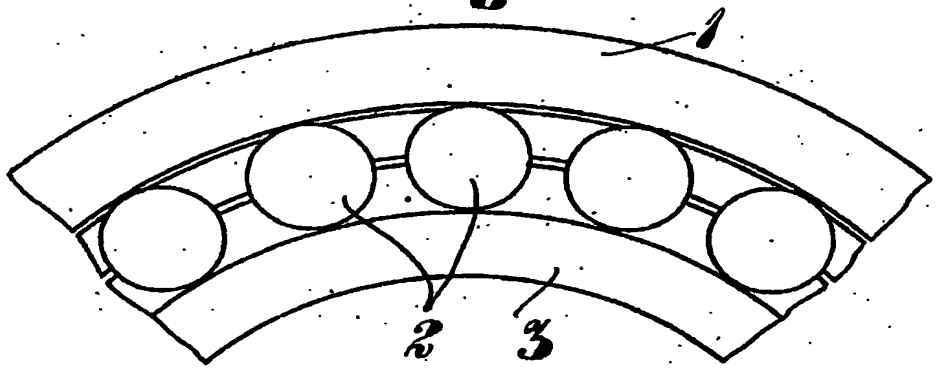


Fig. 3

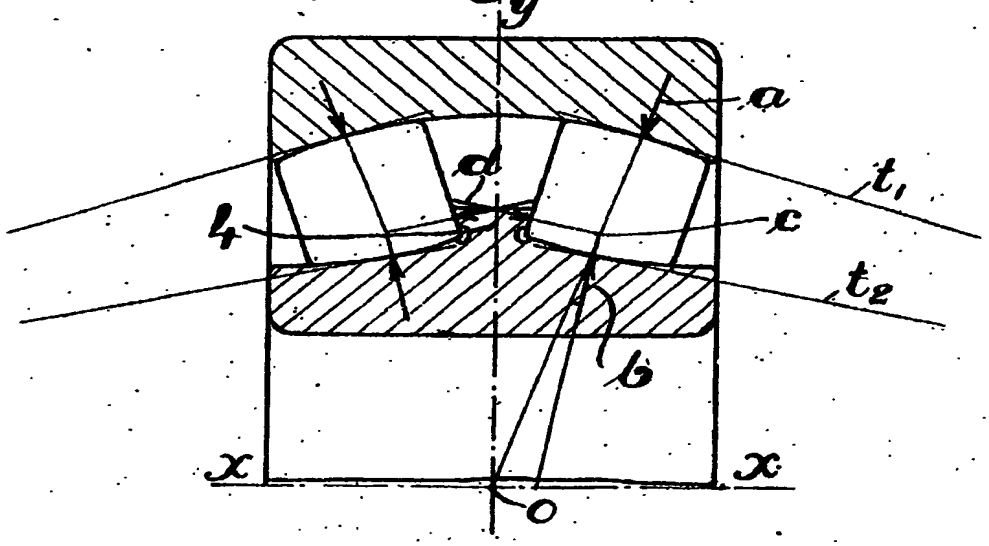


Fig. 4

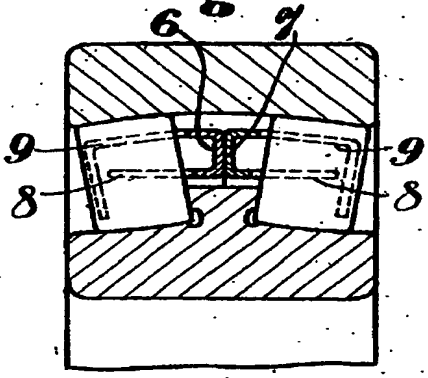


Fig. 5

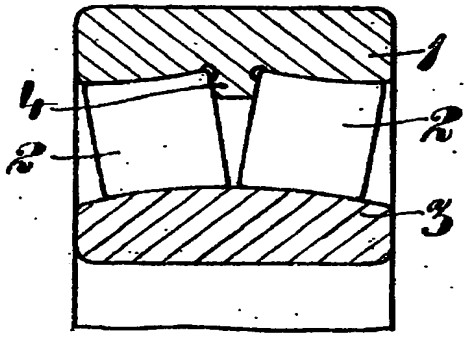


Fig. 6

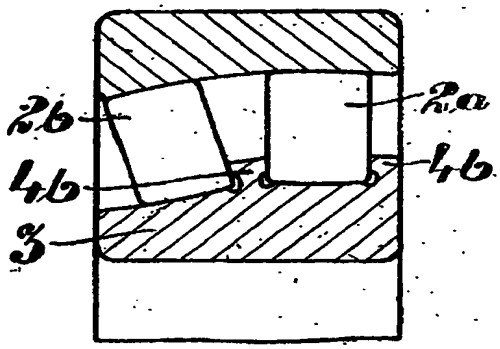


Fig. 7

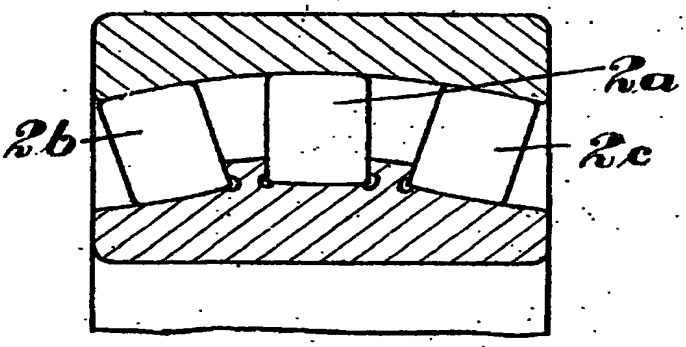


Fig. 8

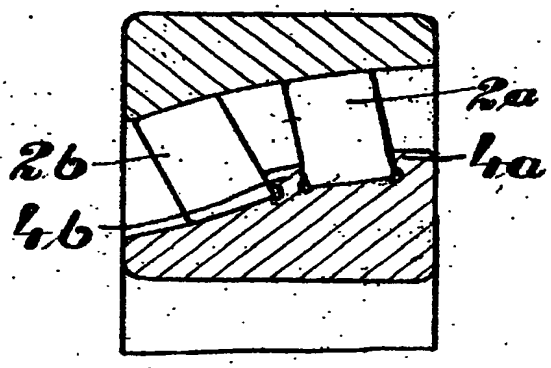
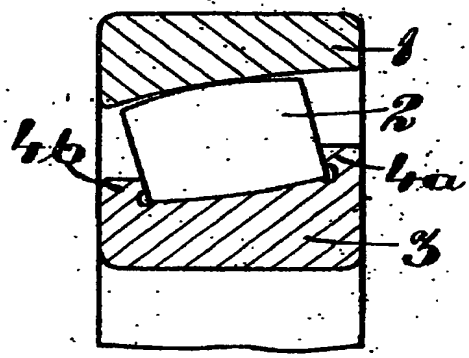


Fig. 9



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